Biomedical & Pharmacology Journal Vol. **8**(Spl. Edn.), 161-167 (Oct. 2015)

Maxillectomy

S. JIMSON[1], LAKSHMI KRISHNAN[1], SUDHA JIMSON[2], B. ANANDH[1] and B. LOKESH[1]

[1]Department of Oral and Maxillofacial Surgery, Tagore Dental College and Hospital, Rathinamangalam, Melakottaiyur Post, Chennai – 600127, India.
[2]Department of Oral and Maxillofacial Pathology, Sree Balaji Dental College & Hospital, Bharath University, Chennai-600100, India.

DOI: http://dx.doi.org/10.13005/bpj/669

(Received: July 25, 2015; accepted: September 10, 2015)

INTRODUCTION

Head and neck surgeries involves various treatment modalities. Of these is maxillectomy. The concept of maxillectomy was first described by Lazars in 1826. After this description it took nearly three years for Syme to perform the first maxillectomy (1829). Earlier attempts at this surgery failed because of excessive bleeding. Bleeding and infection were two factors which caused unacceptable morbidity and mortality in patients following maxillectomy.

In 1927 Portmann&Retrouvey suggested sublabialtransoral approach to remove maxilla. This approach had the advantage of not creating scars extra orally. Rapid advances which took place in the field of anesthesia and surgical techniques in 1950 rekindled the interest in total maxillectomy as a viable treatment option for malignant lesions involving maxilla. It was during this period that Weber Ferguson came out with his epoch making lateral rhinotomy incision which caused very little cosmetic deformity. Later various modifications of these incisions were used to perform maxillectomy.

In 1954 Smith combined total maxillectomy with orbital exenteration. It was only after Smith's demonstration of extended total maxillectomy curative surgery for maxillary carcinomas began to take center stage.

Fairbanks & Barbosa (1961) described infratemporal fossa approach to resect advanced malignancies of maxilla. These tumors were considered to be inoperable till then. In 1977 Sessions & Larson first envisaged medial maxillectomy and were also responsible for coining the term. With the advent of nasal endoscope resection of tumors involving lateral nasal wall under endoscopic vision is the order of the day. This article would provide an insight to maxillectomy.

Definition

A maxillectomy is a procedure to remove a primary tumor in the maxilla. The procedure involves surgical removal of some of the bone, part of roof of mouth possible some of the teeth.

Review of literature

Armany's Classification for Maxillectomy Defects

Armany presented a classification system for maxillectomy defects in 1987[2]. He divided these defects into 6 categories, based upon the relationship of the defect with the abutment teeth

Class I: The resection is performed in the anterior midline of the maxilla, with abutment teeth present on one side of the arch.
Class II: The defect in this group is unilateral, retaining the anterior teeth on the contralateral side.
Class III: The palatal defect occurs in the central

portion of the hard palate and may involve part of the soft palate.

Class IV: The defect crosses the midline and involves both sides of the maxilla, with abutment teeth present on one side.

Class V: The surgical defect is bilateral and lies posterior to the abutment teeth. Labial stabilization may be needed.

Class VI: Anterior maxillary defect anterior with abutment teeth with abutment teeth present bilaterally in the posterior segment.

This is an excellent classification and is devised in order to guide the Prosthodontists in obturator design. It is however deficient in description of surgical defect. It does not provide information about the resection of orbital contents, facial skin or soft palate. It also does not guide the surgeon in surgical reconstruction of the defect.

Spiro Classification of Maxillary Defects

Spiro *et al* reviewed 403 maxillectomies performed between 1984 and 1993 for maxillary carcinoma.They suggested the following classification system:

Limited Maxillectomy

The term "Limited" was applied to any maxillectomy in which one wall of the maxillary antrum was removed.

Subtotal Maxillectomy: Maxillectomy in which at least two walls (including the palatal wall) were removed.

Total Maxillectomy: Complete resection of the Maxilla

While this classification is simple and easy to use, it is incomplete in its description of Maxillary defects. It does not describe whether dento-alveolar part of the Maxilla, orbital contents, soft palate or facial skin was resected or retained. It does not guide the surgeon in reconstruction of the defect.

Liverpool Classification of Maxillectomy Defects

Brown *et al* in 2000, presented data of 45 patients, who had undergone Maxillectomy from 1989 to 1997.4 They classified surgical defects separately according to the vertical and horizontal dimensions of the defect.

Class I: Maxillectomy with no oro-antral-fistula: Removal of alveolar bone that does not result in an oro-nasal or oro-antral fistula. Resection of ethmoidal sinus, frontal sinus and /or lateral wall of nose may also be included in this classification.

Class II: Low Maxillectomy: This resection involves the alveolus and the antral wall, which would inevitably cause oro-nasal or oro-antral fistulae. Orbital floor or rim remains intact.

Class III: High Maxillectomy: In this category floor of the orbit with or without peri-orbital tissue is resected along with the rest of the Maxilla. It may also include skull-base resection.

Class IV: Radical Maxillectomy: Maxillectomy with orbital exenteration with or without anterior skullbase resection.

Horizontal component

a. Resection involves unilateral maxillary alveolus and hard palate, sparing the contra-lateral side and nasal septum.
b. Contralateral Maxilla is partially resected with the ipsilateral Maxilla
c. Alveolar maxilla and hard palate is completed resected bilaterally.

While this is an excellent classification, which not only addresses the vertical and the horizontal component of the surgical defect, it also guides the surgeon in selection of particular type of reconstruction. This classification is however too complicated to use and has failed to acquire wide spread usage.

Cordeiro's Classification of maxillary defects

Cordeiro *et al* reviewed 58 patients who had undergone maxillectomies of varying degrees. These defects were reconstructed using wide variety of flaps. Their aim was to classify maxillectomy in a rational fashion and also to provide an algorithm for reconstruction of these defects.

Their classification was as follows:

Type I (Limited maxillectomy): One or two walls of Maxilla are resected with the preservation of palate.

Type II (Sub-total maxillectomy): 5 out of the 6 walls of Maxilla are removed, preserving orbital

floor.

Type III (Total maxillectomy): Resection of all six walls of Maxilla.

III a: Total Maxillectomy with orbital contents preserved.

III b: Total Maxillectomy with orbital exenteration.

Type IV (Orbito-maxillectomy): Orbital exenteration with resection of upper 5 walls of Maxilla, preserving the palate.

Reconstruction Algorithm

Type I defect: Palate is preserved, by definition, in these defects. Reconstruction with free non vascularized bone may be required to replace bone in critical area, such as orbital rim or anterior floor of orbit. Defect can be further obliterated using RFFF.

Type II defect: RFFF can be used to reconstruct missing palate. An Osseo-facio-cutaneous RFFF can be used to reconstruct the anterior Maxilla, which would provide good support to the lip

Type III a defects: In these defects free nonvascularised bone can be used to reconstruct the orbital floor, while the remaining defect may be obliterated using either Temporalis or Rectus Abdominus flap. Cordeiro *et al* recommended that bone graft must be sandwiched with in the flap

Type III b defect: This is a large defect in which Cordeiro recommended use of Rectus Abdominus flap with skin paddles which may be used to reconstruct Palate, nasal wall or facial skin

Type IV defect: This is a large defect which has an advantage of having palate intact. In these cases, large bulk flap such as Rectus Abdominus with or without skin paddle to reconstruct the defect

While this classification is simply to use and contains easy terminology, it fails to addresses, in its simplicity, those defects which are composite in their content. For example, if base of skull, facial skin or adjacent muscle are removed, they are not mentioned in this classificationThis classification however, provides a guideline for flap reconstruction in these defects. It does not mention rehabilitation through obturators.

Okay's Classification of Maxillary defects

In 2001, Okay *et al* classified palato-maxillary defects into 3 major classes and 2 sub-classes. 6 The aim of this defect oriented classification was to organize and define the complex nature of the restorative decision making process. The classification is as follows:

Class I a: Defects that involve hard palate but not the tooth-bearing alveolus

Class I b: Defects that involve any part of the maxillary alveolus and dentition posterior to the canines or involving the pre-maxilla.

Class II: Defects that involve any portion of the tooth-bearing maxillary alveolus but include only 1 canine.

Class III: Defects that involved any portion of tooth-bearing maxillary alveolus and includes both canines, total palatectomy defects and anterior transverse palatectomy that involved more than half of the palatal surface

Subclasses f and z: Subclass f includes defects that involve the inferior orbital rim whereas Subclass z have defects that involved the body of the zygomatic bone.

Indications of maxillectomy

1. Malignant tumors involving maxilla / lateral nasal wall
2. Fungal infections causing extensive destruction of sinuses
3. Chronic granulomatous diseases involving nose and sinuses
4. As a part of combined excision of skull base neoplasm

Partial maxillectomy procedures are indicated in patients with

1. Slow growing tumors involving nose and sinuses (inverted papilloma)
2. Tumors localized to inferior wall of maxilla

Contraindications of maxillectomy

1. Poor general condition
2. Medically amenable malignancies like lymphoma / rhabdomyosarcoma
3. Systemic disorders like uncontrolled diabetes /compromised heart function
4. Bilateral tumor with bilateral orbital involvement. Removal of bilateral tumors is not only a surgical challenge but also a challenge to design appropriate prosthesis. Moreover if both orbits are involved then

bilateral orbital exenteration cannot be performed lest the patient will be left blind.

Clinical considerations

Important considerations before deciding on surgery:

1. Extent of the lesion
2. Histopathology of the lesion
3. Involvement of adjacent areas
4. Precise location of the bulk of the mass

Role of nasal endoscopy

It helps in examination of the nasal cavity and also provides the first look at the disease process from which biopsy can be done. Spread of lesion outside the confines of maxilla by eroding the antero lateral wall can be ascertained by careful palpation of the anterior wall and in assessing the integrity of the function of the inferior orbital nerve. Erosion of the posterior wall of maxilla with extension of lesion to pterygopalatine fossa can be ruled out clinically by absence of trismus. Histopathological diagnosis is a must before deciding on the optimal management modality. If tumor histology is suggestive of lymphoreticular tumors / rapidly proliferating embryonal tumor like rhabdomyosarcoma then irradiation is the preferred treatment modality.

Role of imaging

1. Both axial and coronal CT will have to be performed in order to ascertain the extent of the lesion.
2. Imaging also helps in deciding the optimal osteotomy location during surgery. The level of frontoethmoidal suture line should be identified well in advance. Superior osteotomy above this level will cause intracranial injury and CSF leak.
3. MRI is indicated in patients who have skull base erosion in order to identify intracranial extension.

Role of prosthodontist

Preoperatively prosthodontist should examine the patient and design an optimal prosthesis which is actually a temporary one. This can be fixed immediately after surgery. Final prosthesis can be fitted after the completion of treatment which includes irradiation / chemotherapy.

Role of ophthalmologist

Ophthalmic examination helps in ruling out ocular involvement. If orbit is involved then maxillectomy will have to be combined with orbital exenteration.

Procedure

This surgery is ideally performed under general anesthesia. Administration of pre-operative antibiotics has been considered to reduce incidence of post op infections. Ideally it should be a broad spectrum antibiotic which could cover the normal flora of nasal and oral cavities

If large amount of palatal tissue needs to be removed to give adequate tumor margins then it is safer to resort to preliminary tracheostomy.

Tarsorraphy is performed on the side of lesion. This helps in protecting eye and cornea from injury. Lateral tarsorraphy alone could be enough if it could provide adequate eye closure. Ideally silk suture material is used to perform this procedure. Before performing tarsorraphy it would be prudent on the part of the surgeon to apply eye ointment in order to prevent excessive drying of cornea.

Ryles tube insertion

This is ideally performed before anesthetizing the patient. Ryles tube in position will help in feeding the patient during the initial post-operative period. Even though it is not a must if inserted serves a good purpose. Hypotensive anesthesia can be administered if there is no contraindication as it would help in minimizing blood loss during the procedure. If endotracheal intubation is preferred to tracheostomy then oral intubation is ideal. The endotracheal tube should be secured to the side opposite to that of the tumor. It is anchored to the lower lip without distorting the upper lip.

Position

Patient is put in supine position with head turned 180° from the anesthetist.

Incision

Even though various incisions are available it is preferred to use Weber Ferguson incision and its various modifications. Modifications of Weber Ferguson incision is necessary if other areas like orbit needs to be attended. Lateral canthotomy can be combined with Weber Ferguson incision to expose orbital boundaries and malar area. Lip splitting incision a modification of Weber Ferguson incision is preferred if infratemporal fossa is involved.

Weber Ferguson incision

Before beginning the process of incision the area should be marked and infiltrated with 1% xylocaine with 1 in 100,000 units adrenaline. This infiltration if done properly will help in minimizing intraoperative bleeding during surgery.

The modified Weber Ferguson incision used in total maxillectomy has three components.

1. Curving incision is given from the medial canthus to the ala of the nose at the nasolabial sulcus.
2. This incision is rounded inferiorly along the upper border of upper lip till the center of the lip is reached. The upper lip is ideally split right in the midline.
3. Infraorbital component of the incision passes about a couple of millimeters from the lower eye lid margin till the malar eminence is reached.

After the incision the skin is spilt till the periostium. This enables cheek flap to be elevated from the antero lateral surface of maxilla in the subperiosteal plane. If the anterior wall of maxilla is eroded by the mass with skin involvement then dissection is slightly altered so that the involved skin overlying the anterolateral wall of maxilla is also removed enbloc along with the tumor.

Probable bleeding sites encountered during this incision

1. Angular vein close to the inner canthus of eye. If not ligated properly may cause some ooze during surgery.
2. When lip is being split right in the middle labial vessels may lead (superior labial artery) pricking.
3. Infra orbital vessels when infraorbital limb of the incision is being made.

Infraorbital nerve is sacrificed after taking a biopsy from it to rule out perineural invasion. This is mandatory in all patients with adenocarcinoma of maxilla. Adenocarcinoma has a potential to spread via nerve sheaths.

After elevating the cheek flap, the inferior and medial periorbita are elevated exposing the following areas:

1. Floor of orbit
2. Lacrimal fossa
3. Lamina papyracea

Identification of lacrimal sac and duct

The lacrimal sac is identified, dissected and retracted.The nasolacrimal duct is usually transected at its junction with the sac and it is marsupialized. This is performed by dividing the sac and suturing the edges to the periorbita. This is a critical step during the procedure as it gives excellent opportunity to the surgeon to identify orbital involvement. If periorbita is involved by the tumor then it calls for histological confirmation of orbital involvement. Frozen section will of used during this stage of the procedure.

Transection of infraorbital rim

This is transected laterally at the malar buttress. Gigli's saw is used.

The medial orbital rim is transected just below the frontoethmoidal suture line. In tumors involving roof of ethmoid require skull base resection in order to provide adequate tumor margins. If fovea is not involved by the disease then ethmoid bone is removed along the frontoethmoidal suture line to provide adequate exposure.

Intraoral phase of surgery

Palatal incision: Incision is made over the hard palate from posterior to the lateral incisor till the junction with that of soft palate is reached. Incision is deepened up to the level of periosteum. At the junction of soft palate the incision curves

horizontally and extended up the maxillary tuberosity where it is rounded.

Division of hard palate

This procedure is done with anosteotome / reciprocating saw. Palatal division is started about 2-3 mm from the ipsilateral nasal septum.This can be modified to suit tumor margins. Lateral incisior if present and uninvolved it can be preserved for prosthesis fitment purposes. The central incisor can be compromised. It is easy to use osteotome from the cavity of central incisor after removing it.

After completing palatal osteotomy the soft tissue attachments between hard and soft palate are freed using sharp dissection / unipolar diathermy cautery.

Osteotomies over lateral orbital wall and posterior floor of orbit are completed thereby allowing down fracture of maxilla. The only attachment remaining at this state is the pterygoid plate.

Attachment of maxilla to pterygoid palate can be removed using a curved osteotome. Maxilla can now be freed by lateral rocking movements. At this stage brisk bleeding may be encountered.

This is usually due to internal maxillary vessels and pterygoid plexus. Packing the entire area using a hot pack will help in controlling bleeding. Majority of this bleeding reduces appreciably with hot packing. In the event of hot packing failing to control bleeding then individual vessels will have to be cauterized using bipolar cautery

After the entire maxilla is removed the area is washed with saline and betadine solution. Temporary prosthesis is inserted.Wound closure is done in layers.

Complications encountered

1. Intraoperative hemorrhage
2. Troublesome Epiphora
3. Damage to orbital structures
4. Damage to cornea
5. Visual disturbances
6. Loss of vision due to over packing the maxillectomy cavity compromising vascularity of optic nerve
7. Velopharyngeal incompetence
8. Cosmetic defects / scars
9. Trismus due to scarring of muscles of mastication.

CONCLUSION

Maxillectomy and midface defects result in major functional and aesthetic abnormalities.Reconstruction depends on the size and individual components of the resected tissue.Large defects often require the use of free tissue transfer Obturation can result in good functional results, but requires constant patient care.

REFERNCES

1. Aramaney MA. Basic principles of obturator design for partially edentulous patients. Part I: Classification. *J Prosthet Dent;* **40**: 554-557 (1978).
2. Spiro RH, Strong EW, Shah JP. Maxillectomy and its classification. *Head Neck*; **19**:309-14 (1997).
3. Brown JS, Rogers SN, McNally DN, Boyle M. A modified classification for the maxillectomy defects. *Head Neck;* **22**: 17-26 (2000).
4. Cordeiro PG, Santamaria E. A classification system and algorithm for reconstruction of maxillectomy and midfacial defects. *Plastic ReconstrSurg;* **105**: 2331-2346 (2000), discussion: 2347-8.
5. Okay DJ, Genden E, Buchbinder D, Urken M. Prosthetic Guidelines for surgical reconstruction of the maxilla: a classification system of defects. *J Prosthet Dent;* **86**: 352-63 (2001).
6. Bidra AS, Jacob RF, Taylor TD. Classification of maxillectomy defects: a systemic review and criteria necessary for a universal description. *J Prosthet Dent*; **107**:261-70 (2012)

7. Maxillectomy-a review by Dr.Balasubramanium.
8. Cordeiro PG and Disa J. *Seminars in Surgical Oncology* **19**: 218-225 (2000)
9. Santamaria E and Cordeiro PG. *Journal of Surgical Oncology* **94**: 522-531 (2006)
10. Futran ND. *J Oral MaxillofacSurg* **63**: 1765-1769 (2005)